PART 5

PROCESS REQUIREMENT

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PART 5 PROCESS REQUIREMENT

5. PROCESS REQUIREMENT

Process, hydraulic and other plant design requirements for Replacement of existing Electro-mechanical units and construction of new Disc filter Unit of this Contract are described herein Part 5 – "Process Requirement".

5.1. Scope of Work The following works needs to be done as part of this contract,

1. Dismantling and demolition of Existing inlet structure to STP and Design and construction of new inlet structure with vortex type grit removal system.
2. Design and construction of New Disc cloth filter unit to consistently achieve TSS <10mg/l and ensuring consistent achievement of BOD < 10mg/l.
3. Replacement of complete electromechanical and ICA system of the Phase I Raja canal STP.
4. Re-routing of existing internal recycle pipeline from inlet of existing anoxic zone to the downstream of the anoxic zone to convert the anoxic zone into anaerobic zone.
5. Construction of a partition wall (as a submerged weir) in the aeration tank to create anoxic zone of 6.6 ML volume (4 hrs HRT)
6. Replacement of old surface aerators with aspirating type of aerators along with Air Blowers; Total of 32 aerators of 37.5 HP rating approximately to be installed.
7. New SCADA system for central monitoring of the complete plant to be done.
8. New Scrubber system along with complete ducting and other safety requirements for Chlorination system.
9. Enhancing the present chlorinators capacity to match design flow
10. New Alum dosing system.

Contractor to take a note that the following equipment in Raja Canal Phase 1 are replaced already as follows:

1. Raw Sewage Pumps in TSPS- 3 nos. (not part of this contract) replaced in the year 2021.
2. Anoxic Mixers- 2 nos. replaced in the year 2021.
3. Chlorination system, motive water pumps and safety equipment replaced in the year 2019.

Note: Contractor to take a note that their technical expert team should plan for site visits and evaluation of all the existing equipment. Based on the same detailed report to be submitted to the client for their review as per their scope of work mentioned above. Complete background study needs to be performed by the contractor for Upgradation of Raja Canal Phase- I STP.

5.2. Demolition or Interfaces and Tie-Ins with Existing Facilities

All existing facilities that are to be demolished shall be properly decommissioned, removed, and appropriately disposed-off by the Contractor in accordance with all applicable laws, regulations, and standards. Items, components, or materials, whether buried, exposed, submerged, or otherwise, shall not be abandoned or left on site unless explicitly indicated in the Bidding Document. For facilities that are to be eventually demolished but must remain in service until alternate or replacement facilities are constructed and commissioned, whether under this Contract or a different Contract, the Contractor shall ensure that the facilities are protected and remain functional until such time as the alternate or replacement facilities are constructed, tested, commissioned, and accepted by Employer.

All existing facilities that must remain in service permanently shall be protected by the Contractor such that they remain fully functional, operable, and serviceable throughout construction, testing, and commissioning of the new facilities. The Contractor shall be fully responsible for installation and, if necessary, ultimate removal of any temporary facilities or connections (piping, utilities, power, controls, etc.) that may be necessary to maintain existing facilities fully operational throughout construction and commissioning. Temporary or permanent interfaces between existing and new facilities may involve making connections or "tie-ins" to existing live structures, piping, wiring, cabling, equipment or other components. The Contractor shall be fully responsible for detailed design, planning, and implementation of such interfaces in a safe and secure manner.

5.3. Modular Design, Construction, and Operation for Reliability, Redundancy, Turndown, and Easy Future Expansion

The initial design capacity and the ultimate build out design capacity required are both specified in Paragraphs 5.1 for the STP. This paragraph shall be read in conjunction with other relevant paragraphs and parts of the Bidding Documents.

For all components under this Contract, the capacity to be provided shall be designed and constructed using multiple, suitably sized unit process modules to ensure reliability, redundancy, and appropriate turndown for optimum capacity utilization and process efficiency. The minimum number of working and standby modules or units required for each component shall be as listed in Paragraph 5.17, 5.18 and Part 11 of the Bidding Documents.

5.4. Design of Plant Layout

The proposed STP components shall be laid out and fully contained within the respective designated site boundaries so as to logically interface with the sewers and/or pumping mains that are to be connected to STP to be constructed under this Contract and all existing infrastructure that may be present at the sites and that must remain in service, if and as appropriate.

The Contractor's proposed site layout for proposed works of STP shall clearly show the space allocated for all plant components, including those components and/or unit processes that are designated for future construction or installation. Setbacks and clearances from the site boundary

shall be provided as appropriate and as required by law.

All existing utilities (including water, sewer, power, or others, whether overhead or underground and whether physically located on the site or not) requiring to be relocated to accommodate the Contractor's proposed and approved site layout shall be relocated by the Contractor at no additional cost and without interrupting provision of such utility services to users and customers. Such relocations shall be fully coordinated with the Employer.

The plant layout shall adhere to the following minimum requirements, regardless of whether or not such requirements or any related components are shown in any drawings or specifically listed or described in any part of the document included in the Contract Document.

- Minimum clear distance provided to permit safe and convenient access for operation and maintenance shall be 3m between adjacent treatment units or fixed structures and 1.2m between pieces of equipment.
- Minimum clear distance of 1.2m shall be provided between two adjacent screen channels to permit safe and convenient access for operation and maintenance.
- Access and maintenance lay down area shall be provided adjacent to all mechanical equipment.
- All electrical equipment (except for motors) shall be located above the high flood level elevation for the site or for the effluent receiving water body, whichever is higher.
- All process units / storage tanks shall be labeled with name, sizes and volume. Letters shall be of a size suitable for the application but shall not be less than 100mm high. Labels shall be located at 90-degree intervals at a suitable elevation.
- All plant items for mechanical, electrical and instrumentation shall be fitted with a unique name plate bearing the individual plant reference name for the plant item.
- Contractor shall generate master asset database of each plant (ISPS, TSPS and STPs) under this contract and should update same during O&M period. Further, all assets shall be labeled with unique asset number with barcode which shall be linked to master asset database of plant and shall provide all details of asset when scan the barcode.
- Access facilities shall be provided for People with Disabilities; at minimum for all the locations at Finished Ground Level and Finished Floor Level.
- Minimum 1500 mm wide continuous walkway shall be provided for walkthrough of liquid stream process units which shall start at Inlet Chamber of STP, move along the Fine Screens, Vortex Grit Chambers and connect to the existing walkway adjacent to the existing Aeration basins. Crossing of this walkway with plant internal road shall be painted as "WALKWAY".
- Minimum 1200mm clear width of platform shall be provided to all proposed units and any other location as required to meet the access requirement as specified in tender.

- Vehicular access shall be provided for all plant structures and buildings.
- All plant internal roads and plant approach road shall be of asphalt macadam and minimum width shall be as specified in tender document.
- All the roads shall be provided with minimum Curb radius of 3.5m unless specified otherwise.
- All roads shall be provided with storm drain on either side of road or single side based on drainage flow pattern and shall be constructed to prevent standing water.
- All the roads shall be provided with painted concrete curb stone on both side of road with minimum concrete curb stone height as 300mm.
- Minimum 750mm of paved walkway shall be provided on either side of road which shall be 300mm above the road surface. Contractor shall propose storm drain below this walkway.
- Contractor shall ensure that all plant internal roads shall be provided with 100mm edge line marking, this shall be marked at 300mm away from curb stone on both sides of road with industrial grade paint.
- Proper drainage of the area around all the buildings shall be provided to avoid stagnation of rain water to prevent malarial conditions.
- Contractor shall appoint dedicated Architectural Engineer for developing Architectural view of complete plant, further contractor shall ensure that architectural view of all process and non-process building shall reflect the current era architecture as approved by Engineer.
- Contractor shall appoint dedicated Landscaping Engineer for developing Landscape layout around proposed units, further contractor shall ensue that landscaping view around proposed units should be pleasant and shall reflect modern landscaping practice of current era.
- Plantation & horticultural activities of landscaped area shall be properly maintained to give pleasant environment of build out campus throughout the O&M period.
- The speed limit for all vehicles within plant boundary shall be not more than 15kmph and same shall be displayed at suitable locations within plant road, at least at road intersection. Further, all the road intersection within plant shall be provided with direction boards at suitable elevation as directed by Engineer.
- Display hoarding for safety signs at suitable elevation shall be provided both indoors and outdoors. These safety signs shall cover mandatory, prohibition, warning, emergency, fire- fighting and general notices as directed by Engineer.
- Display hoarding of painted plant layout shall be placed outside the admin building at suitable elevation as directed by Engineer.

5.5. Design Requirements

The following design requirements shall be meant for all STPs and Pumping Mains. These requirements shall be fully met regardless of whether or not such requirements or any related components are shown in any drawings and other documents included in the Contract Document.

- The Contractor shall perform a complete Hazardous Area Classification analysis as per IS 5572 for all proposed units of the STP in this contract and shall submit a complete report of such analysis as well as Hazardous Area Classification Drawings that delineate boundaries of all classified areas and indicate the classification of each area. All electrical or other powered equipment, instrumentation, or components shall fully comply with all requirements of IS 5571.
- All components (including but not limited to equipment such as pumps, blowers, screens, diffusers, inline devices; instruments such as flow meters; and distribution and collection channels or pipes) shall be provided with appropriate isolation devices such as valves, gates, or other devices in order to allow isolation, drainage, cleaning, calibration, servicing, and maintenance of such components.
- Bypasses shall be provided around all flow meters and other in-line instrumentation such that the instrument can be isolated and removed for calibration and maintenance without interrupting the flow, regardless of whether or not such bypasses are shown in any drawings included in the Contract Document.
- All equipment, where necessary and particularly blowers, shall be provided with acoustic, sound-dampening enclosures to limit ambient noise during normal operation to the limits as detailed in Part 14.
- Suction air filters provided for air blowers of aspirating aerators shall be capable of supply the process air that should not contain more than 0.02 mg of dust per m^3 of process air.
- All equipment shall be arranged, and buildings and structures designed to permit safe and easy access to and removal of all equipment.
- Fixed runways, lifting eyes, cranes, hoists, or other appropriate devices and means shall be provided to permit safe and easy removal of all equipment for maintenance or any other purpose.
- Minimum 1.5 factor of safety shall be incorporated over maximum weight to lift while selecting the capacity of any type of lifting device.
- All Structures shall be designed for uplift in empty condition with water table as per geotechnical recommendations . The structures shall be designed to counteract any possible floatation without the use of any type of groundwater pressure relief valves, including during construction.
- The floors of all liquid-holding structures shall be appropriately sloped and trenches and drain sumps shall be provided at the bottoms of such slopes to facilitate complete drainage of liquid. Appropriate drain pipes and valves connected to the drain sump(s) shall be provided for all structures. Where the drain pipe connects to the structure, the top-of-pipe elevation shall be at least 150 mm lower than the lowest floor elevation for the structure. The drain piping shall be

routed from the structure being drained to the Plant Drain Pump Station. For liquid-holding structures, the drain piping and fittings shall be sized such that the entire structure can be drained by gravity in no more than eight (8) hours. The Plant Drain Pumps, and other related equipment and controls shall be designed and sized to allow draining of the structure with the largest volume from full to empty within eight (8) hours. The highest design water level (High-High Alarm) in the Plant Drain Pumping Station wet well shall be at least 300 mm lower than the lowest pipe invert elevation amongst all drain pipes connecting to the wet well.

- Non-liquid-holding areas, structures, or buildings where leakage or other wet activities can occur, whether in normal use or during maintenance, shall be provided with covered drainage channels which shall direct the spillage either to a suitable gravity drain or to a sump equipped with standard dual submersible sump pumps discharging to the Plant Drain Pump Station.
- Interceptor and containment bunds shall be provided for containment of all chemicals, fuel and wash water as a resultant from spillages and overflows. The Contractor shall take due regard to the potential of hazardous mixing of chemicals, particularly as a result of leaks and spillages, and their drainage and containment.
- All concrete structures in contact with sewage and/or sludge shall be provided with full interior corrosion protection linings and/or coatings; this shall applies to all concrete structures in contact with any type of sewage and/or sludge anywhere in the plant including but not limited to complete works of Inlet works, Channels etc.,
- All channels carrying process liquid shall be fully covered with solid non-skid GRP cover plates (not grating) designed for human traffic live loads at a minimum and heavy vehicle live load wherever the channel crosses traffic paths.
- Inlets into tanks, reactors, or other structures via pipes, channels, valves, or gates shall be designed such that the incoming flow does not cause any damage or excessive wear whatsoever to the structure (including corrosion protection linings and/or coatings) or any equipment in the vicinity under any hydraulic condition, including but not limited to the condition when the structure is empty.
- Walkways, flooring, hand railing, Plant, etc. shall be designed to take account of the prevailing conditions and be of corrosion-resistant materials. The Contractor's attention is drawn in particular to areas including, but not limited to proposed units for Inlet Works.
- All walkways and staircase shall be provided with non-skid floor tiles of industrial grade designed for human traffic live loads and equipment load that carried on walkway.
- Dedicated working area shall be provided on aeration tank for proper access, lifting and maintenance of installed mixers, valves, flow meters and pumps.
- Contractor shall provide dedicated working area on aeration tank for proper lifting, maintenance and reinstallation of proposed aspirating aerators. For this, contractor shall provide minimum 2400 mm clear width of operating platform for aeration tanks
- Platforms, handrails/guardrails, ladders, stairs and safety chains shall be provided for proper, safe,

and easy access to and/or operation of valves, gates, instruments, control panels, and other devices, equipment, or structures, as well as removal of the above items. All platforms and handrails shall be provided with toe guards of minimum 100mm width.

- RCC staircases shall be provided to all treatment plant units, flow dividing chambers and other structures to connect to the elevated RCC walkway platforms for which the height of the floor above finished ground level exceeds that in the prevailing standard.
- All piping shall be of corrosion–resistant material appropriate for the service and shall be provided with interior lining, exterior coating, and other corrosion protection as appropriate and necessary to meet the requirements for design life. All piping shall be fully and adequately supported and braced to comply with all applicable codes and standards. All supporting hardware shall also be of corrosion-resistant material. The design of pipe supports, and anchors shall fully account for static and dynamic vertical, lateral, longitudinal, and seismic loads, fluid flow, and thermal expansion. Seismic bracing thrust restraints and/or thrust blocks, and appropriate expansion joints or loops shall be provided as needed. Pipe lengths and joints shall be assembled and arranged for ease of removal in such a way that individual runs can be changed without dismantling adjacent pipes, by providing dismantling joints at regular intervals.
- All mixed liquor and sludge lines shall be provided with appropriate cleanouts and flushing arrangements for safe and easy flushing using high-pressure water of minimum 3.5kg/cm^2.
- All liquid service pipes shall be provided with appropriate means for safe and easy drainage of the pipes when not in service.
- All pipelines shall be color banded and suitably labeled with the stream designation and direction of flow to enable individual lines to be identified throughout their run. Particular attention shall be paid to the painting of each chemical line, which shall be based on type of chemical flowing in pipe.
- Particular attention shall be paid to the layout of the chemical piping, which shall be arranged without clutter and shall be functional and neat in appearance. Generally, where piping is installed in ducts, it shall be supported not less than 250 mm clear of the floor.
- All piping routed under any type of structure or equipment shall be fully and completely encased in reinforced cement concrete, with the encasement thickness beyond the outer diameter of the pipe being at least 200 mm on all sides. The encasement shall extend along the pipe length for a minimum horizontal distance of 1500 mm in each direction beyond the footprint of the overlying structure or equipment.
- All piping connecting to, entering, or exiting any and all structures shall be provided with appropriate restrained flexible connections and/or joints at all such interfaces with structures to allow for differential movement between pipe and structure in all directions without stressing or breaking the pipes.
- Appropriate restrained flexible connections and/or joints shall be provided for all pipes where

they connect to any and all of the following:

- Equipment such as pumps, blowers, or inline devices
- Valves
- Wall, floor, or roof penetrations

- Where piping or other materials susceptible to damage from direct sunlight/ultraviolet radiation, they shall be protected from such light/radiation through the use of appropriate additives and/or coatings and shall be physically shielded from direct sunlight/ultraviolet radiation at all times (including prior to and during installation) in their normal service location using enclosures, covers, canopies, roofs, and/or other similar means.
- During cleaning cycle of centrifuge, no spillage or washed flows of centrifuge shall fall on the floor of sludge loading area from sludge hopper; design of centrifuge piping arrangement and sludge hopper shall be done such that all washed flows of centrifuge shall pass through centrate line of centrifuge.
- High pressure water jet spray shall be provided to clean the accumulated screening material from both mechanical coarse screen and fine screens to ensure smooth operation while resume from standby to working condition and vice versa.
- Appropriate sampling ports and/or sampling valves shall be provided to allow easy, safe sampling of all process streams without spillage or contamination and without the need to interrupt normal operation.
- Foam, scum, fats, oil, grease, or any other floating material removed from any location in the STP shall be completely removed from the process flow path and under no circumstances returned / recycled to any location in the plant.
- All spare requirements specified for disc filter cloth, mixers and other spare parts of electromechanical equipment shall be instantaneous. (i.e., equal amount of used spare shall be replaced with new spares to maintain the minimum spare quantity specified in bidding document) throughout the O&M period.
- While selecting any type of pump and blower, priority shall be given to higher pump/blower efficiency and lower power consumption and shall ensure that pump/blower can operate at high efficiency throughout its service life. At minimum, contractor shall ensure efficiencies of pump/blower as listed below:
  - Minimum efficiency of Submersible Pumps shall be 70%
  - Minimum efficiency of Axial Tubular Pump (MLR) shall be 70%
  - Minimum efficiency of RAS Pump (Horizontal/Vertical Non-clog solid handling) shall be 65%.
  - Minimum efficiency of Rotary Tri-Lobe blower shall be 70%
  - Minimum efficiency of Centrifugal Turbo blower shall be 90%
- The Works shall be designed and operated and maintained to minimize odours within, at the boundary of and in the vicinity of the Sites. The layouts of the Works shall take account of the

prevailing wind direction and speed at different times of the year. Mature trees shall be provided around the full boundary of all sites, except for at accesses to the sites.

5.6. Hydraulic Design Requirement

A representative layout for proposed units of the STP are included in Volume 4 of this Bidding Document. These drawings shall be considered representative only. In the event of any conflicts between information in the drawings and Part 5, then Part 5 – "Process Requirements" shall govern in accordance with the Priority of Documents.

Contractor shall submit self-explanatory hydraulic design calculations in editable MS-Excel format and shall ensure that the plant layouts and hydraulic profiles shall comply with the following specific and all other requirements described in the Bidding Document:

- For STPs where all or part of the influent flow is pumped from an ISPS outside the plant boundary, the Contractor shall connect the pumping main from the ISPS to the inlet Chamber of STP as per the battery limits specified for the works.
- The Contractor shall provide at the STP all necessary facilities for manual bypass of the process liquid at various locations in the flow path as indicated below. These facilities are included in this contract and shall be provided regardless of whether or not they are shown in any drawings included in the Bidding/Contract Document. They shall be fully functional in all respects and shall include any and all components necessary to safely and efficiently accomplish the intended bypass. Each bypass facility shall include, but not be limited to: (i) downward opening overflow weir installed in the appropriate channel or structure from which the bypass is to be affected, (ii) an appropriately sized buried (above ground piping will not be acceptable) pipe to carry the bypass flow from the channel or structure. An appropriately sized flow meter along with all associated components and infrastructure to automatically measure and record details of all bypass events, including but not limited to date, start time, end time, continuous flow rate data for the entire duration of the event, and a totalized volume for the event, shall be provided.
- At minimum, the following locations at the STP shall be provided with bypass flow arrangement which shall be sized to handle plants peak flows for respective design period as specified in the tender document:
    - At the Downstream of the Grit Chambers and upstream of the Parshall Flume to the final outfall structure by gravity.
    - At the upstream of Filters to the final outfall structure by gravity
- Location of outfall structure to discharge treated sewage shall be as directed by Engineer. However, contractor shall ensue that outfall structure shall be located nearest to the receiving water body and flow shall be discharged with cascade effect.
- Topographical survey information, benchmarks, contour maps, geotechnical/soil investigations, and effluent receiving water body high flood level (HFL) elevations for ISPS, TSPS and STP sites

and sewer and pumping main alignments are included with these Bidding Documents and/or available from the Employer on request. However, the Employer makes no guarantees or representations whatsoever regarding this information. The Contractor's use of this information shall be at his own risk. The Contractor shall independently obtain any and all site information necessary for proper planning, design, construction and operation and maintenance of all Works/components in the Contract.

- All aspects of the design of the hydraulics shall be based on sound principles and good common engineering practice typical for sewage treatment works.
- All process units shall be capable of passing the required peak sewage flows, including returned flows as specified.
- All the flows shall be evenly distributed between the numbers of process units in operation for all flow conditions.
- The hydraulic design calculations shall demonstrate the hydraulic functioning of the STP if any one of the process units were to be out of service for maintenance.
- Hydraulic calculations shall be based on the Hazen-Williams formulae for pipe and the Manning equation for open channel flow.
- For STP hydraulics, Hazen-Williams co-efficient of 100 shall be considered for all liquid pipelines for gravity and pumping design.
- For all type of gravity channels, Manning co-efficient of 0.015 shall be considered in design.
- The head loss calculations in all sludge pipe work shall take account of the specific sludge characteristics for different types of sludge including the variations in viscosity arising from changes in the dry solids content and characteristics of the sludge.
- If Contractor's design of sludge line hydraulics is based on Hazen-Williams formula then, Hazen-Williams co-efficient of 60 shall be considered for all sludge piping both for gravity and pumping design.
- The division of flow between the individual treatment units shall be achieved by:
    - Non-submerged (i.e. with a positive freefall from weir invert to the water surface on the downstream side) overflow weirs followed by isolation gate.
    - Non-submerged downward opening overflow weir gates.
    - All air / sludge flow distribution shall be with automatic feedback flow control using inline flow measurement and modulated flow control valves with actuators and data input and control through PLC/SCADA.
- Sharp crested weirs with free discharge shall be used and shall be designed to include adequate provision for maintaining atmospheric pressures beneath the nappe.
- A positive freefall of at least 150mm shall be provided to upstream weir crests under peak flow conditions with all streams operational.
- All the flow distribution boxes shall be equipped with adjustable weir plate for equal flow

distribution to each side of weir plate. Further, weir followed by isolation gate shall be provided for each weir side of flow distribution box.

- Weir length of flow distribution box shall be designed to give maximum 150mm of head over the weir at peak flow condition.
- SS 316 weir plate with minimum 6mm thick shall be provided on each weir side of flow distribution box and shall be capable to adjust at least 75mm of its height unless specified otherwise.
- For flow distribution box, at least 1.5m of clear liquid height shall be provided between tip of the weir and invert level of flow distribution box, unless specified otherwise.
- Where flow distribution box receives the flow from channel, the connecting point between incoming channel and flow distribution box shall be provided with minimum 600mm of chamfer followed by under flow baffle wall.
- All pipes and channels shall be provided with proper slope based on calculation. Also, shall ensure that provided slopes shall facilitate draining of pipes and channels when required during maintenance. At minimum following slopes shall be considered in design unless specified otherwise:
    - All pipe lines carrying plant drain and scum shall be provided with minimum 1% of slope.
    - All channels carrying liquid shall be provided with calculated slope or minimum 1% of slope
    - All gravity sludge lines shall be provided with minimum 1.25% of slope
    - All below ground pumped sludge lines shall be provided with minimum 0.4% of slope.
    - Gravity flow either liquid or sludge shall not be permitted to flow against the slope.
- Bed level of all channels shall be provided with slope, Slope shall be provided either by constructing the bed level of channel as per calculated slope or by providing screeding in channel. If channel is provided with screeding to achieve slope, then a minimum 50mm thick screeding shall be considered at lowest discharge point of channel and accordingly calculated slope shall be provided to upstream side of channel. Contractor shall make a note that flat-bed level of channel without slope is not accepted.
- All corners of channel in contact with liquid shall be provided with fillet having minimum radius of 150mm. Further, change in flow path/direction of channel shall be achieved with smooth curve to avoid turbulence in flow.
- Special care shall be taken to control turbulence, where Raw Sewage, RAS and MLR flows discharge into aeration tank. Following design feature are illustrated to control the excessive turbulence in both anaerobic zone and anoxic zone and other process unit locations:
    - Construction of the drop chimney/chamber which shall drop the flows to 600mm above bottom of tank. Further plan area of drop chimney/chamber shall be based on velocity criteria which shall be not more than 0.45m/s based on flow to be handled. Alternatively,

Construction of the under-flow baffle wall across the flow path which shall terminate 450mm above the bottom of tank with 5minutes retention time based on plant average flow.

- Contractor may carryout CFD analysis and results of same shall be incorporated in General arrangement drawings of following process units at minimum:
    - STP Inlet Chamber with Fine Screens o
    Anaerobic, Anoxic and Aerobic zone o
    Secondary Clarifiers
- All below water RCC columns proposed in aeration tank or any other process unit shall be circular in shape.
- Minimum number of subzones with physical partition to be provided in each anaerobic and anoxic zone is indicated in paragraph 5.17. However, contractor shall ensure that flow path through subzones of each anaerobic and anoxic zone shall create the long plug flow condition.
- Submersible type mixer shall be installed in each subzones of anoxic zone. Further, mixer shall be in a location where it shall create dispersion to mix and not to settle condition in flow path of each sub-zone.
- For all structures containing water or process liquid, the minimum freeboard (distance by which top of wall / bottom of slab in case of walkway or closed tank is higher than the maximum water surface level at receiving water under one unit out of service condition for all flow condition shall be 0.5m unless specified otherwise.
- All pumps shall have flooded suction and negative suction shall not be allowed in pump selection.
- Maximum pipe flow velocity shall be no more than 1.0 m/s for all gravity flow and pump suction lines unless specified otherwise.
- Maximum pipe flow velocity shall be no more than 2 m/s for all pumped discharge lines unless specified otherwise.
- Calculated normal velocity (at 20°C and 1atm) of air piping shall not be more than 16 m/s.
- For channels, the maximum velocity shall be no more than 1.0 m/s.
- For liquids the maximum velocity through gate opening shall be no more than 0.8 m/s unless specified otherwise.
- Maximum velocity through inlet ports of secondary clarifier shall be not more than 150 mm/s.
- The size of magnetic flow meter shall be same as that of pipe diameter unless specified otherwise.
- The minimum elevation difference between High water level and High-High water level shall be at least 300mm.

5.7. Plant Water System

The entire plant water requirement shall be taken from treated water storage tank and shall be used for multiple applications including but not limited to all chemical solution preparation, motive water system, filter backwash system, thickener dilution water (As applicable refer Paragraph 5.17), general cleaning

and flushing needs also for landscaping requirements. Further, plant water shall meet "Non- Detectable Fecal Coli-form" standards wherever it has possibility of direct or indirect human contact.

A separate overhead tank shall be provided for plant water system. A pressurized plant water booster system shall be provided to supply plant water to all of the selected applications through pressurized plant water ring main. Plant water booster system shall be designed to maintain a minimum pressure of 4.0 bar at the furthest point on the ring main from the booster set under conditions of maximum plant water in use. Pressure gauges complete with isolation valves shall be provided and fitted to all delivery lines and booster set pressure vessels.

The plant water ring main shall have hose connection hydrants as required for cleaning of principal process units and equipment. All potential points of spillage shall be provided with hose connection hydrants for washing down within buildings and areas where sludge or liquor spillage will occur. All such hydrants shall be specially identified as "Non-Drinking Water".

5.8. Process and Facilities Description

This Process and Facilities description is intended to provide the processes and types of facilities that the Contractor shall be required to design, construct, and operate, and apply to proposed units of the STP in this Contract unless specifically indicated otherwise. The Contractor shall use this description together with other specific information for the STP provided elsewhere in this Bidding Document, including but not limited to Paragraph 5.12, Part 11, & Volume 4 – "Drawings", all of which are integral to this Process and Facilities Description and are incorporated herein by reference. Contractor shall strictly comply with the specified treatment concept, treatment unit processes, flow configuration (connectivity between unit processes and facilities), performance requirements (such as effluent and sludge quality and equipment efficiencies), and design criteria (such as design operating conditions, various process loading rates and/or detention times, requirements for units out of operation, volumes, and dimensions where specified) such as the minimum requirements specified in the paragraph 5.12. Complete operation of the equipment at TSPS/ISPS, and STP shall be as defined in control philosophy.

5.8.1. Receiving Chamber/Inlet Chamber

The sewage from proposed 80 MLD TSPS shall be pumped through flow meter and pumping main to the proposed receiving chamber. Receiving Chamber shall be adequately sized to receive the full peak flow of 80 MLD plus recycle or backwash flow from Disc filters. The receiving chamber is to be designed for a detention time of 15 seconds. The size of receiving chamber shall be 6 meters x 3 meters x 1.60 meters SWD. The contractor to note that the raw sewage pumping main from 80MLD TSPS is not under the scope of this contract. However, new pumping main from existing 20MLD ISPS to be laid upto inlet chamber of STP with required capacity pumps and pipelines arrangements as per the directions of the engineer-in-charge is included in this contract.

5.8.2. Mechanical Fine Screen Channel

Three numbers of fine screen channels are to be provided, to install two working and one standby fine screens designed for total peak flow 3333.33m^3/hr with appropriately sized isolation gate(s) upstream and downstream of each screen. The Fine Screens will have openings of 6mm and will be placed in concrete channels. An electronically controlled automatic jam removal system shall be provided in addition to the safety devices. The screenings removed by the screens shall be discharged at the appropriate elevation above ground on to a conveyor. A screw or belt conveyor positioned above ground level shall convey the screenings through a SS-304 chute to a screening collection Bins of 3nos. and capacity of 500kg as per vender requirement positioned at ground level. The proposed length of fine screen channels is 8 meters and width is 1.5 meters with depth of water in channel at peak flow is 0.70 meters.

5.8.3. Mechanical Fine Screen outlet Channel

The screened sewage from the fine screen channel will be conveyed by gravity to outlet channel with gate opening to channel of length 3 m and width of 6 meter and water depth of 1.60 meters.

5.8.4. Vortex Type Grit Chambers

The screened sewage shall flow by gravity through a common channel into two (working) Vortex type Mechanical Grit Chambers of size 5.5 meters diameter and 1.7 meters side total water depth, each sized for full peak flow and constructed in RCC. Each Grit chamber shall be designed for a peak flow of 3333.33 m3/hr. A set of grit separators to be provided downstream of the screens. Removal of grit from municipal sewage is necessary to protect equipment from damage and excessive wear due to abrasion from grit. Grit removal protects moving mechanical equipment from abrasion and accompanying abnormal wear, reduces pipe clogging caused by deposition of grit particles or heavy sludge in pipes and channels, and settling-tank cleaning required as the result of excessive accumulations of grit in these units. Hydrodynamic vortex circular type Grit Remover system is proposed. It employs a circular RCC tank equipped with a turbine type rotor to control velocities. Collected grit flown along with some sewage, to a screw classifier for final separation of the grit from the water. The vortex Grit separator system is designed to separate high density grit particles from lower density organics by means of a rotary vortex impeller. Grit particles travel to the perimeter of the round tank and settle into the bottom sump where they are intermittently extracted by means of an airlift blower or grit pump. Organics and larger objects remain suspended and leave the chamber to be processed downstream. The separated grit shall be washed and classified/dewatered using inclined gravity separators with surface organic return to the inlet of Grit Chamber. The washing/dewatering system to be designed for an organic matter content of less than 10% of the dry solids content (in the cleaned grit) measured on a weight (w/w) basis.

5.8.5. Aspirating aerators

It is proposed to replace the existing surface aerators with aspirating type of aerators along with air blowers; total of 32 aerators with 37.5 HP rating to be installed. Blowers will be mounted on the pontoon itself or on the existing bridge structure that holds the surface aerators. Hence separate air

blower building is not required.

Alum dosing is proposed to achieve <1mg/l of phosphorus at outlet. Further, to avoid chemical dosing, it is proposed to convert existing anoxic tank into anaerobic tank, and construct anoxic zone of 6.6ML volume with 4hr retention time in the aerobic zone by constructing a partitional baffle wall. Re-routing of existing internal recycle pipeline from inlet of existing anoxic tank to the downstream of the anoxic

tank to convert the anoxic tank into anaerobic tank. The size of the new anoxic zone shall be 21.17mL x 40mW x 3.95m LD.

5.8.6. Mixed Liquor Recycle (MLR) Pumps

Each MLR pump included in this contract shall be designed and constructed for year 2034 flows; MLR pumps shall be provided for all STPs to facilitate pumping of aerobically treated mixed liquor to the influent end of the anoxic zone. These pumps shall be physically located in appropriately sized De-aeration zone. MLR flows to each tank shall be measured with flow meter and all flow events shall be recorded and controlled through PLC/SCADA.

5.8.7. Alum Dosing System

Each dosing pump for alum included in this contract shall be designed and constructed for year 2034 flows; an alum dosing system shall be provided for chemical phosphorus removal in the event of inadequate biological removal.

For all STPs, a common set of alum dosing pump shall pump the alum to aeration basin effluent channel or other suitable location which meets the Employer's Requirements.

5.8.8. Return Activated Sludge and Waste Activated Sludge

Each Return Activated Sludge (RAS) pump included in this contract shall be designed and constructed for design flows; for the STP, RAS pumps shall be provided to return settled sludge from the secondary clarifiers to the proposed anaerobic zone of each aeration basins. Each clarifier shall be provided with dedicated RAS pump with valve-controlled and metered (magnetic type flow meter) tapping on suction side of clarifier.

Waste Activated Sludge (WAS) flow shall be tapped from common RAS discharge line and controlled with eccentric plug valve with magnetic type flow meter and all flow events shall be recorded and controlled through PLC/SCADA system. No separate WAS pumps shall be provided. Discharge of RAS flows to each aeration basin shall be metered (magnetic type flow meter) and controlled through PLC/SCADA system taking into account system inputs.

5.8.9. Centrifuge

Centrifuge of 30 m3/hr (1W+1S) and all its ancillary equipment including auto poly dosing system should be introduced in place of the conventional old sludge drying beds.

5.8.10. Equipment and Instrument replacement

All electromechanical equipment and ICA system to be replaced except those listed in clause 5.1. Complete automation package inclusive of actuators, instruments, PLC, I/O racks, HMIs and SCADA terminal is proposed.

5.8.11. Inlet Drop Chamber of Disc Filters

The Final effluent from secondary clarifier shall flow by gravity to the Drop Chamber of Disc Filter from where it shall be flow to Disc Filter. RCC access platform, staircase and railing shall be provided as per requirement. The drop chamber of length 8.3 m and width of 2.5 m.

5.8.12. Disc Filtration & Building

Cloth Media Disc Filtration System shall be provided to treat the effluent received from Drop chamber. The proposed Disc Cloth Filtration Technology shall have a number of discs attached to a rotor drum. Each disc consists of easily dismantled filter cassettes provided with filter cloth. The filter media shall be made of 10 micron woven polyester cloth and pre-mounted on the individual filter cassettes. The filtration can be in-to-out or vice versa, with suitably equipped backwash mechanism. Suspended solids are separated and accumulate on the filter cloth clogging the filter media and increasing the head-loss. When the water level inside the filter tank increases to a pre-set point the filter rotor starts rotating and the backwash of the filter media starts. The backwash removes the accumulated suspended solids into the backwash/ reject stream. The suspended solids are then discharged via the reject pipe. The disc filters can be furnished with glass fiber reinforced plastic (FRP) cover with safety interlocking system for the purpose of service and inspection. To open-up the permanently clogged pores of the filters – mainly due to inorganic precipitation (hardness, etc.), the filter discs will be chemically cleaned. A portable automatic chemical cleaning unit with storage capacity of 70 lit of chemical shall be provided for the cleaning. The unit shall be such that it can be moved from one disc filter to another and connected to the PLC of the control panel of the machine to clean the unit.

5.8.13. Outlet Drop Chamber of Disc Filters

The Outlet Drop Chamber of Disc Filter shall have a pumped flow which shall be designed for 850 m3/hr 4W+ 2S from where it shall be pumped to CCT Chlorine Mixing Tank. RCC access platform, staircase and railing shall be provided as per requirement. The Outlet drop chamber of length 8.3 m and width of 5 m.

Two Disc Filters are proposed with peak hour filtration rate of 3333 m^3/hr. The Disc Filters shall be housed in a covered building with dimension 18.2 m L x 14 m W and 6.4 m Ht.

5.8.14. Final Effluent

Final effluent from outlet of chlorine contact tank included in this contract shall be designed and constructed for 80MLD peak flow; Further, flow from outlet of CCT shall be measured before it discharges to River/Lake/Nalla through proposed outfall structure. All flow events shall be linked to the PLC/SCADA system to allow daily totalized flow and other flow trends.

5.8.15. Sludge Treatment

WAS flow tapped from common RAS discharge line shall be sent to centrifuge feed sump.

Where thickener is provided, WAS flow shall be discharged to thickener distribution chamber. Flow from thickener distribution chamber shall be sent to thickeners, which shall be Circular picket fence type, Center column supported with central drive. Dilution water facility shall be provided to meet the hydraulic loading criteria of thickener and same flow shall be pumped to inlet of thickener distribution chamber. Overflow from thickeners shall be sent back to plant drain sump and under flow sludge line from thickeners shall be connected to centrifuge feed sump, whereas scum flow shall be sent to scum pit. Contractor shall ensure that only filtrate from the scum shall be sent to scum pit whilst collected scum shall be disposed properly. Diameter of Stilling box/Feed well/Diffusion mechanism located at the centre of the thickener shall occupy a minimum of 15% of the thickener diameter. Stilling box/Feed well baffle shall extend to a minimum of 1.2m below water surface and extend to a height 300 mm above the water surface. Water spray bar for flushing thickener water surface shall be provided. Further, for top entry inlet pipe to thickener, pipe shall terminate minimum 600mm below the stilling box water surface.

Sludge dewatering system shall include centrifuge feed pumps, solid bowl decanter centrifuge, complete auto-polymer system, dewatered sludge conveyors, sludge storage/loading hoppers, and truck access and loading facilities. Sizing of the centrifuges and all related equipment shall be based on the operating schedule specified in elsewhere in this Tender document.

5.8.16. Flow Measurement

A complete flow measurement facility shall be provided at minimum locations as specified below to measure the flows at minimum 99% accuracy. All equipment and components necessary for a fully functional facility shall be provided for all flow measurement locations regardless of whether or not such items are specifically listed or described in the Bidding Document.

a) Overflow/bypass flow measurement at Downstream of the Grit Chambers and upstream of the Parshall Flume.

b) MLR flow measurement to each Anoxic zone and Anaerobic zone

c) RAS flow measurement to each Anaerobic zone and Anoxic zone

d) WAS flow measurements

e) Flow measurement on common alum dosing line

f) Flow measurement on suction side of each clarifier for RAS flows

g) Bypass flow measurement for disc filter

h) Flow measurement to delivery side of each centrifuge feed pump

i) Poly dosing flow measurement to each centrifuge

j) Final effluent flow measurement at outlet of CCT

k) Flow measurement to common delivery side of Plant Water Pumps

l) Flow measurement to Disc Filter outlet Pumps

All the above locations (And Parshall flume that shall be provided after grit chamber) shall be provided with continuous flow measurement. Flow measurement devices shall provide instantaneous and totalized flow records and signals. Flow measurement devices shall be linked to the PLC/SCADA system to allow daily totalized flow and other flow trends to be analyzed, recorded and for control of process as specified in tender document.

5.9. Sampling/Analysis Locations and Frequencies

Sampling and analysis shall be performed to measure the parameters indicated in the table below, at the locations and frequencies indicated in the table. In case of multiple units (such as multiple aeration basins, multiple clarifiers), the indicated sampling and analyses shall be performed for each individual module. Further, Contractor shall ensure that all the historical sampling data and analysis results shall be stored in database and made available to Employer till end of contractor's O&M period.

Parameter	Frequency	Measurement / Sampling Method	Points / Locations
pH	Continuous	Online	1) Raw Sewage at TSPS 2) Sewage at D/S of Parshall Flume 3) Final Effluent
	Daily	Grab sample	1) Anaerobic Zone 2) Anoxic Zone 3) Aerobic Zone 4) All plant bypass flows 5) Sludge cake from centrifuge
COD	Daily	Flow-weighted 24-hours composite sample	1) Raw Sewage at TSPS 2) Sewage at D/S of Parshall flume 3) Final Effluent
		Grab sample	1) All plant bypass flows
	Continuous	Online	1) Raw Sewage at TSPS 2) Final Effluent
rbCOD	Daily	Flow-weighted 24-hours composite sample	1) Raw Sewage 2) Sewage at D/S of Parshall flume
TSS	Daily	Flow-weighted 24-hours composite sample	1) Raw Sewage at TSPS 2) Sewage at D/S of Parshall flume 3) Final Effluent

Parameter	Frequency	Measurement / Sampling Method	Points / Locations
		Grab sample	1) All plant bypass flows 2) Waste Activated Sludge (WAS) 3) Sludge feed to Centrifuge 4) Sludge cake from centrifuge 5) Plant Drain Flows
	Continuous	Online	1) Raw Sewage at TSPS 2) Final Effluent
VSS	Daily	Flow-weighted 24-hours composite sample	1) Raw Sewage at TSPS 2) Sewage at D/S of Parshall flume 3) Final Effluent
		Grab sample	1) All plant bypass flows 2) Waste Activated Sludge (WAS) 3) Sludge feed to Centrifuge 4) Sludge cake from centrifuge 5) Plant Drain Flows
Chlorine	Daily	Grab sample	1) All plant bypass flows 2) Final Effluent Plant Water
	Continuous	Online	**1)** CCT Outlet
Turbidity	Continuous	Online	1) U/S of Disc Filter D/S of Disc Filter
ORP	Continuous	Online	1) Anaerobic Zone 2) Anoxic Zone Chlorine Contact Tank
BOD_5 at 20°C	Daily	Flow-weighted 24- hours composite sample	1) Raw Sewage at TSPS 2) Sewage at D/S of Parshall flume Final Effluent
		Grab sample	1) All plant bypass flows 2) Sludge cake from centrifuge Plant Drain Flows
	Continuous	Online	1) Raw Sewage at TSPS Final Effluent
TKN	Daily	Flow-weighted 24- hours composite sample	1) Raw Sewage at TSPS 2) Sewage at D/S of Parshall flume Final Effluent
	Continuous	Online	1) Raw Sewage at TSPS

Parameter	Frequency	Measurement / Sampling Method	Points / Locations
Ammonia-N	Daily	Flow-weighted 24- hours composite sample	1) Raw Sewage at TSPS 2) Sewage at D/S of Parshall flume Final Effluent
		Grab sample	1) All plant bypass flows 2) Anaerobic Zone 3) Anoxic Zone
	Continuous	Online	1) Raw Sewage at TSPS Final Effluent
Nitrate-N	Daily	Flow-weighted 24- hours composite sample	1) Sewage at D/S of Parshall flume Final Effluent
		Grab sample	1) All plant bypass flows 2) Anaerobic Zone 3) Anoxic Zone 4) Aerobic Zone
Total Nitrogen	Daily	Flow-weighted 24-hours composite sample	1) Final Effluent
		Grab sample	1) All plant bypass flows Sludge cake from centrifuge
	Continuous	Online	1) Final Effluent
Alkalinity	Daily	Flow-weighted 24-hours composite sample	1) Raw Sewage at TSPS 2) Sewage at D/S of Parshall flume Final Effluent
		Grab sample	1) All plant bypass flows 2) Anaerobic Zone 3) Anoxic Zone
Total Phosphorus	Daily	Flow-weighted 24-hours composite sample	1) Raw Sewage at TSPS 2) Sewage at D/S of Parshall flume Final Effluent
		Grab sample	1) All plant bypass flows 2) Anaerobic Zone 3) Aerobic Zone
	Continuous	Online	1) Raw Sewage at TSPS 2) Final Effluent
Fecal Coli-form	Daily	Flow-weighted 24-hours composite sample	1) Raw Sewage Final Effluent

Parameter	Frequency	Measurement / Sampling Method	Points / Locations
		Grab sample	1) All plant bypass flows Plant Water
Total Coli-form	Daily	Flow-weighted 24-hours composite sample	1) Raw Sewage Final Effluent
		Grab sample	1) All plant bypass flows Plant Water
VFAs	Daily	Flow-weighted 24-hours composite sample	1) Raw Sewage at TSPS Sewage at D/S of Parshall flume
		Grab sample	1) Anaerobic Zone
MLSS	Daily	Grab sample	2) Anaerobic Zone 3) Anoxic Zone Aerobic Zone
MLVSS	Daily	Grab sample	1) Anaerobic Zone 2) Anoxic Zone Aerobic Zone
Temperature	Daily	Online	1) Raw Sewage at TSPS 2) Sewage at D/S of Parshall flume 3) Anaerobic Zone
Specific Gravity	Daily	Grab sample	1) Chemicals 2) Sludge
Concentration / Water Content	Daily	Grab sample	1) Chemicals 2) Sludge Grit
Organic Content	Daily	Grab sample	1) Grit
Volume	Daily	Grab sample	1) Chemicals 2) Screenings 3) Grit
Sludge Volume Index	Daily	Grab sample	1) Aeration Basin Effluent Channel
DO	Daily	Grab sample	1) Raw Sewage at TSPS 2) Sewage at D/S of Parshall flume Final Effluent
	Continuous	Online	1) Aerobic Zone

Parameter	Frequency	Measurement / Sampling Method	Points / Locations
Microscopic Examination	Monthly Once or as needed	Grab sample	1) Raw Sewage at TSPS 2) Anaerobic Zone 3) Anoxic Zone
Odour	Weekly	Japanese Offensive Odor Control Law (Law No. 91 of 1971, Latest Amendment by Law No. 71 of 1995). **Or** Prevailing Indian Standard as directed by Engineer	1) TSPS 2) Preliminary Units 3) Sludge Handling Units All Pump House Building
	Monthly		1) Plant Boundary
Noise	Daily	Decibel Meter	1) All process buildings including pump house
	Monthly	Decibel Meter	1) Plant Boundary

All costs associated with the sample collection and lab analysis shall be met by the Contractor. The analysis shall be carried out and shall be performed in strict compliance with appropriate analytical methods published in Indian Standards, or in "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, or as published by the US Environmental Protection Agency.

In addition, the Contractor is required to validate its analysis on effluent samples weekly once from an approved laboratory (by Bureau of India Standards), which is not connected to the Project. The validation sampling shall be randomly taken based on Employer decision and the cost of validation/ analysis shall be borne by the Contractor.

During the entire operation and maintenance period, Employer shall nominate their official/counterparts for the inspection of specific STP(s) on a weekly basis. Employer shall also nominate a qualified person to carryout periodical inspection of the STP(s) and to conduct surprise checks, without prior notice to the Contractor.

Employer shall check the effluent quality of the STP(s) every day and instruct the Contractor to undertake appropriate remedial measures, if the performance of the plant is observed as not satisfactory.

Employer shall engage an approved agency (or Bureau of Indian Standards Certified Laboratory) for assessing the effluent quality, for which the samples shall be jointly collected by the Employer (or Bureau of Indian Standards Certified Laboratory) and the Contractor.

In the event of breakdown of the flow-weighted 24-hours composite sample equipment, sampling shall be undertaken manually in a day at every two-hour interval and the results shall be weighted according to flow in order to establish the equivalent daily total load.

5.10 STPs Design/Sizing Criteria and Other Requirements

Contractor shall submit self-explanatory process design calculations in editable MS-Excel format considering the requirements specified in Part 5 and elsewhere in this Bidding Document. Further contractor shall also submit simulation Model of process design by using GPS-X software.

Below Notes are pertaining to design and sizing criteria specified in following tables:

a) All the process unit sizes/volumes specified are minimum.

b) All the building dimensions (or Area when calculated) specified are minimum; However, Contractor may upsize these dimensions (or Area when calculated) based on design to meet the specified tender requirements

5.10.1 STP Minimum Requirements

Item/ Parameter/ Description	Units	Raja Canal Phase 1 STP
Treatment Process Proposed for upgradation		Conventional Activated Sludge Process (Biological Nutrient Removal – A2O)
Influent Wastewater Characteristics		
pH		6.5-7.5
BOD	mg/L	350
COD	mg/L	800
TSS	mg/L	450
VSS	mg/L	380
TKN	mg/L	70
NH_4-N	mg/L	45
Total Phosphorus	mg/L	7
Alkalinity	mg/L as $CaCO_3$	370
Min. Sewage Temperature (Tmin)	^{O}C	24
Max. Sewage Temperature (Tmax)	^{O}C	27
Min. Ambient Temperature	^{O}C	15
Max. Ambient Temperature	^{O}C	45
Treated Effluent Quality Requirements (at outlet of Chlorine Contact Tank)		
pH – instantaneous range		6.5 –9.0
BOD_5 at 20^0C	mg/L	10
COD	mg/L	50
TSS	mg/L	10
NH_4-N	mg/l	5.0
N Total	mg/L	10
Alkalinity – min instantaneous	mg/L as $CaCO_3$	70
Total Phosphorus	mg/L	1
Residual Chlorine – min instantaneous	mg/L	1
Fecal Coliform (maximum allowable)	MPN/100 mL	100

Item/ Parameter/ Description	Units	Raja Canal Phase 1 STP
Note: All weather auto-sampling and analysis devices shall be provided to monitor above all parameters.		
Treated Sludge Quality Requirements (Dewatered Sludge)		
Sludge Quality		Dewatered sludge cake
Maximum Sludge VSS/TSS	%	70%
Minimum sludge TSS (dry solids) for Sludge	% w/w	20%
STP Inlet and Outlet Hydraulic Conditions		
Receiving water body / unit		Minor irrigation department pumping to Chikkaballapura/Kalkere Lake
Flow Capacity to STP		
Total Flow to existing STP (average)	MLD	40
Peak flow for inlet works	MLD	80
Average Initial Capacity (Qini) Total	cum/hr	1666.67
Fine Screen Influent Channel		
No of Streams		2
Flow to each stream	MLD	40
Min No of Units per stream		1
Type		Rectangular/ Tapered
MOC		RCC
Peak channel velocity at peak flow	m/s	0.75
Max SWD at peak flow	m	1.50
Min Freeboard	m	0.50
Fine Screen Channels		
Screen type		Bar screen with mechanical cleaning
Min No of Units – Working per stream		1
Min No of Units – Standby		1
MOC – Channel		RCC
MOC – Screens (all screen components)		SS 316
Angle of inclination of screen	deg.	75
Max SWD at peak flow	m	1.2
Velocity through openings at peak flow	m/sec	1.20
Clear spacing between bars	mm	6
Minimum bar thickness/width	mm	4 x 8
Minimum bar dimension in direction of flow	mm	40
Bar cross-section		Trapezoidal
Max width per channel	m	2.50
Min freeboard	m	0.50

Item/ Parameter/ Description	Units	Raja Canal Phase 1 STP
Min channel length	m	3 times & 2 times of width of the screen channel on upstream & downstream respectively.
Fine Screen Effluent/Grit Basin Distribution Channel		
Flow	MLD	80
No of Streams		2
Flow to each stream	MLD	40
Min No of Units per stream		1
MOC		RCC
Peak channel velocity at peak flow	m/s	0.75
Max SWD at peak flow	m	0.80
Min freeboard	m	0.50
Min no. of branch boxes		2
Box width	m	1
Box min freeboard	m	0.50
Grit Basin – Vortex Type		
Type		Vortex with center drive
Min No of Units – Working per stream		1
Min No of Units – Standby		-
MOC – Structure		RCC
MOC – Equipment/Mechanism		SS 316
Minimum Diameter of Grit Basin	m	5.0
Dia of Particle	mm	0.15
Grit Removal Rate	%	90.00
Grit Generation Rate	m^3/mL	0.20
Recycle Configuration		
RAS Ratio - hydraulic design		1.00
Anaerobic Zones		
Anaerobic Zone Sizing		
No. of streams		2
Minimum Anaerobic HRT	hr	1.7
Minimum Anaerobic volume - Total	cum	2844
Min No of Zones per Basin		1.0
Direct pumping turnover frequency	per hr	1
Anoxic Zones		
Anoxic Zone Sizing		
No. of streams		2
Min Anoxic Volume - Total	cum	6690
Min no of anoxic zones per basin		1
Minimum Anoxic HRT	hr	4.0

Item/ Parameter/ Description	Units	Raja Canal Phase 1 STP
Mixing rate	W/m^3	10
Anoxic Mixers		Refer Part-11, Volume-2
Direct pumping turnover frequency	per hr	1
Aerobic Zones		
Aerobic zone DO (minimum)	mg/L	2
Aerobic Zone Sizing		
No of streams		2
Min Aerobic Volume - Total	cum	25,000
Min no of aerobic zones per basin	Nos.	1.0
Minimum SRT	days	6
Process Aeration		
AOR - peak (minimum net oxygen requirement - field conditions)	kg/h	770
Type of Aeration		Aspirating aerators
Max Alpha Factor, α		0.60
Max Beta Factor, β		0.95
Peak SOTR	kg/h	1,444
Aspirating Aerators		Refer Part-11, Volume-2
Mixed Liquor Recycle Pumps		Refer Part-11, Volume-2
Aeration Basin Effluent Channel		
No of streams		1
Min No of Units for 40 MLD		1
MOC		RCC
No of passes		2
Pass width	m	2
Min Freeboard	m	0.5
Alum System		
Alum Dose Calculation		
Aeration basin effluent soluble P	mg/L	1.00
Plant effluent target SOP	mg/L	0.25
Commercial alum form - design		Dry cake/brick
Dry Alum Storage		
Dry alum design storage period	days	30
Dry alum storage type		Cake/brick stacks in building
Alum Solution		
Purity of Alum	%	99
Alum Solution Strength	% w/w	10%
Alum solution design storage period	day	1
Alum Solution Tank Mixers		Refer Part-11, Volume-2
Alum Dosing Pumps		Refer Part-11, Volume-2
Alum Dispersion Rapid Mixer		Refer Part-11, Volume-2
Secondary Clarifiers		
Surface Area/ unit	m^2	855.3

Item/ Parameter/ Description	Units	Raja Canal Phase 1 STP
Retention time	Hours	3.6
Dimensions		Refer Part-11, Volume-2
RAS Pumps		Refer Part-11, Volume-2
Centrifuge		
Type, Capacity and Quantity		Refer Part-11, Volume-2
Auto Poly Dosing system		Refer Part-11, Volume-2
Sludge Thickener		
Solid Loading rate	$Kg/m^2.day$	25
Type		Central drive
Dimensions		Refer Part-11, Volume-2
Thickened sludge feed pumps		Refer Part-11, Volume-2
Supernatant pumps		Refer Part-11, Volume-2
Filtrate Pumps		Refer Part-11, Volume-2
Cloth Media Disc Filter		
Design load factor for Inlet TSS to Disc Filters	--	1.5
Overflow Rate (At Peak design flow condition)	$m^3/m^2/h$	10
Maximum Filtration rate (at Avg. design flow condition) with all units in service shall be .. effective filtration surface area.	$m^3/m^2/h$	10
Maximum Filtration rate (at peak design flow condition) with all but one unit in service shall be .. effective filtration surface area.	$m^3/m^2/h$	15
Outlet TSS from Disc Filter (max.)	mg/l	10
Pore size of filter cloth	µm	10
Type of filter cloth	-	Pile
MOC of filter cloth	-	Polyamide or Polyester
SWD of filter	m	2
Chlorine Gas Feed System		
Minimum chlorine dose	mg/L	5
Peak chlorine feed rate	kg/day	400
Chlorine Ton Cylinders		
Min storage period	days	15
Max withdrawal rate per 900 kg cylinder	kg/hr	6
Min no of cylinders - total		4
Min no of cylinders - manifold with automatic switching		3
Chlorinators and Chlorine Ejector		Refer Part-11, Volume-2

End of Part 5